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SPACE STATION TRACE CONTAMINANT

CONTROL

NAS8 36406

MONTHLY PROGRESS REPORT

FOR

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PREPARED BY

R. B. JAGOW

PREPARED FOR

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

GEORGE C. MARSHALL SPACE FLIGHT CENTER

BIOTECHNOLOGY

LMSC, INC.

MONTHLY PROGRESS REPORT

Contract NAS-36406

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I. WORK PERFORMED DURING THE REPORTING PERIOD

The month of October was spent working on the Space Station Contaminant Control Analysis Computer Program, on Microbial Monitoring, and on RLSE contaminant control system test recommendations.

Coding of the main program and of the subroutines is continuing. A preliminary version of the data input calculation section has been coded and is being checked out. At present it appears that the basic convergence methodology and mass balance operate successfully.

Work has continued on the Space Station microbial monitoring task. The majority of work was devoted to Task B, microbial monitoring support area requirements. The following is a listing of criteria which was developed to evaluate the suitability of inflight microbial monitoring systems:

* provide on-orbit analysis
* contain equipment capable of monitoring airborne, waterborne, and vehicle surface contamination
* produce accurate results rapidly
* require minimal crew time and attention
* utilize reagents which are compatible with the ECLSS
* minimize power, weight, and volume penalties

It is difficult to establish quantitative requirements which correlate the numbers of microbes present with the status of a healthy, non-infectious environment. On-orbit monitoring of microbes serves a useful purpose by providing data which can be used to determine baseline levels of Space Station cleanliness. Quantitative data, by itself, is meaningless. Assessment of Space Station cleanliness is possible, however, when baseline data is evaluated with respect to other factors such as crew health status.

The Center for Disease Control (CDC) and American Hospital Association (AHA) recommend routine environmental monitoring (culturing) for the following purposes: to monitor the preparation of infant formula, to assess the effectiveness of disinfection procedures of respiratory therapy and anesthetic equipment, and to assess the effectiveness of sterilization processes where spores are used for procedure validation. Routine environmental monitoring for other purposes is not recommended except when used in conjunction with attempts to pinpoint the source of an existing infection outbreak. Routine environmental monitoring that is not recommended includes culturing to check operating cleaning or housekeeping practices, routine air sampling, and testing for contamination of sterile commercial products.

The recommendation of the CDC and AHA for the elimination of most routine environmental monitoring is applicable to Space Station. After the establishment of baseline cleanliness levels, microbial culturing on a routine basis becomes an unproductive and time consuming procedure. The elimination of routine environmental monitoring also parallels the microbial monitoring that is planned for the crew. Crew microbial monitoring will be performed on a symptomatic basis only; no routine monitoring is planned.

Regardless of the frequency of routine environmental monitoring, the need for inflight monitoring system still exists. Vendor sources and trade analyses of microbial monitoring systems have begun.

RLSE TEST RECOMMENDATIONS

The RLSE and Space Station contaminant control systems compared in Table 1 are extremely close in design except for the following differences:

* Flow rate through the fixed bed: 40 cfm RLSE, 7.4 cfm SS
* Regenerative bed used in RLSE and not included in SS design

It is therefore recommended that the regenerative bed be left unpacked and the ducts to the fixed bed and regenerative bed be orificed to provide the Space Station flow to each loop. The small differences in fixed bed diameter and length are not of concern, because the design has been shown to be very insensitive to bed L/D ratio and bed velocity. Even though the Space Station design shown in Table 1 is for a single 6-man centralized system, the use of a distributed system will not change the testing methods or results because reasonable bed velocity and residence time can be maintained in the distributed system, particularly with the insensitivity to L/D ratio and bed velocity. It is therefore further recommended that contaminants be introduced into the RLSE system at the full Space Station load model rates to verify system performance. Information on two peristaltic pumps that could be used for contaminant introduction is enclosed. Long term testing will be required to check bed breakthrough unless extremely high introduction rates are used. The latter will increase the total amount absorbed by the fixed bed, however.

II. WORK PLANNED FOR THE NEXT REPORTING PERIOD

* Work will continue on updating the contaminant load model with information on ECLSS contaminant generation data and on contaminants generated by EVA activities.

* Work will continue on checking out the main computer program logic.

* Coding of the computer subroutines will begin.

* Work will continue on analyzing microbial monitoring systems.

III. PROBLEMS

None

TABLE 1

COMPARISON OF RLSE AND SPACE STATION BASELINE SYSTEMS FOR TRACE GAS CONTAMINANT CONTROL

	RLSE	Space Station
Fixed Charcoal Bed:		
Diameter	38.1 cm (15 in)	30 cm (11.8 in)
Length	63.5 cm (25 in)	83 cm (32.7 in)
Weight	30.4 kg (76 lb)	30 kg (66.1 lb)
Flow	1130 l/min (40 SCFM)	210 l/min (7.4 SCFM)
Pressure Drop	2.5 in water	0.8 in water
Charcoal only weight	21.8 kg (48 lb)	21 kg (46.3 lb)
diameter	33.0 cm (13 in)	29.3 cm (11.54 in)
length	38.1 cm (15 in)	58 cm (22.84 in)
volume	32.6 l	39.2 l
density	0.48 g/ml	0.54 g/ml
Pre-Sorbent Bed:		
LiOH weight	0.91 kg (2.0 lb)	same
Lenth	15.2 cm (6.0 in)	same
Diameter	12.7 cm (5.0 in)	same
Flow	127 l/min (4.5 SCFM)	105 l/min (3.7 SCFM)
Pressure Drop	0.95 in water	0.8 in water
Weight	1.6 kg (3.5 lb)	same
Post-Sorbent Bed:		
LiOH weight	1.36 kg (3 lb)	same
Length	22.2 cm (8.75 in)	same
Diameter	12.7 cm (5.0 in)	same
Flow	127 l/min (4.5 SCFM)	105 l/min (3.7 SCFM)
Pressure Drop	1.55 inwater	1.2 in water
Weight	2.0 kg (4.5 lb)	same
Catalytic Oxidizer:		
Catalyst volume	0.9 l (54.5 in3)	same
Length	35.5 cm (14 in)	same
Diameter	20.3 cm (8 in)	same
Power	142 watts	same
Weight	14.1 kg (31 lb)	same
Flow	127 l/min (4.5 SCFM)	105 l/min (3.7 SCFM)
Pressure Drop	6 in water	5 in water